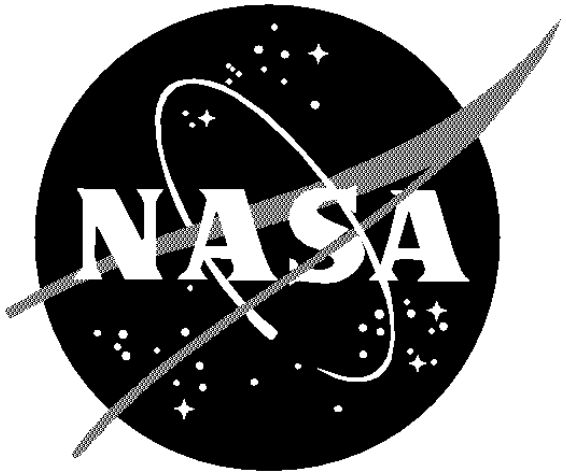

National Aeronautics and Space Administration

July 21, 1999

NRA-99-OES-03

RESEARCH ANNOUNCEMENT

TROPICAL RAINFALL MEASURING MISSION (TRMM) SCIENCE:

POST-LAUNCH RESEARCH OPPORTUNITIES

Letter of Intent due August 23, 1999
Proposals Due October 4, 1999

OMB Approval No. 2700-0087

TROPICAL RAINFALL MEASURING MISSION (TRMM) SCIENCE: POST-LAUNCH RESEARCH OPPORTUNITIES

NASA Research Announcement
Soliciting Research Proposals
for
Period Ending
October 4, 1999

NRA-99-OES-03
Issued July 21, 1999

Office of Earth Science
National Aeronautics and Space Administration
Washington, DC 20546

NASA RESEARCH ANNOUNCEMENT
TROPICAL RAINFALL MEASURING MISSION (TRMM) SCIENCE:
POST-LAUNCH RESEARCH OPPORTUNITIES

I. INTRODUCTION

The National Aeronautics and Space Administration (NASA) announces the solicitation of research proposals to conduct scientific investigations in the Earth sciences discipline of precipitation science and related tropical energetics in connection with the Tropical Rainfall Measuring Mission (TRMM) launched in November 1997. This opportunity, which follows earlier TRMM research announcements in 1997 and 1998, is intended to support TRMM related investigations for a 3-year period in two areas. The first area is to continue and enhance existing investigations related to algorithm development, validation, and applications. TRMM science research consists of a broad range of investigations covering modeling and analysis, algorithm improvements, applications and outreach efforts. Approximately one half of the selected investigations will be related to these efforts. The second area of emphasis deals with the analysis of TRMM validation data collected during five Field Experiments. Emphasis here will given to the validation of TRMM products and improvement of physical understanding resulting from the TRMM Field Campaigns. A technical description of investigations of interest appears in Appendix A. Approximately $3.0 million per year is expected to be reserved in each area to support the science investigations, subject to availability of funds. It is anticipated that an average NASA award will be funded in the range of $80,000 to $120,000 per year.

Participation in this program is open to all categories of domestic and foreign organizations, including educational institutions, industry, non-profit institutions, NASA centers, and other U.S. agencies. In accordance with NASA policy, all investigations by foreign participants will be conducted without any exchange of funds, i.e., investigators whose home institution is outside the United States cannot be funded by NASA. Proposals may be submitted at any time during the period ending October 4, 1999. NASA reserves the right to consider proposals received after that date in accordance with Appendix B, paragraph 11, i.e., “the selecting official deems the late proposal to offer significant technical advantage or cost reduction.” Proposals submitted to NASA will be evaluated through a scientific peer review. Selection is expected to be announced during February 2000.

All prospective proposers are strongly encouraged to submit a letter of intent to propose to this Announcement by August 23, 1999. This letter should contain a brief description of the research to be proposed.

Technical information contained in Appendix A applies to this Research Announcement only. Appendix B through D contain NASA general guidelines for the preparation of proposals solicited by this Research Announcement.

Identifier: **NRA 99-OES-03**

Submit Letter of Intent to:
Tropical Rainfall Measuring Mission
Code Y
400 Virginia Avenue, SW, Suite 700
Washington, DC 20024

Submit Proposals to:
Tropical Rainfall Measuring Mission
Code Y
400 Virginia Avenue, SW, Suite 700
Washington, DC 20024
Washington, DC 20024

Number of Copies Required: 10

Selecting Official:
Director, Research Division
Office of Earth Science
NASA Headquarters

Obtain Additional Information From:
Dr. Ramesh Kakar
TRMM Program Scientist
Code YS
NASA Headquarters
300 E Street, SW
Washington, DC 20546
Telephone: (202) 358-0240
FAX: (202) 358-2770
email: Ramesh.Kakar@hq.nasa.gov

Please use identifier number NRA-99-OES-03 when making an inquiry regarding this Announcement. Your interest and cooperation in participating in this effort are appreciated.

ORIGINAL SIGNED BY

Dr. Ghassem Asrar
Associate Administrator
Office of Earth Science

NASA RESEARCH ANNOUNCEMENT
TROPICAL RAINFALL MEASURING MISSION (TRMM) SCIENCE:
POST-LAUNCH RESEARCH OPPORTUNITIES

APPENDIX A
TECHNICAL DESCRIPTION

This Announcement seeks investigations related to Tropical Rainfall Measurement Mission (TRMM). TRMM is one of the satellite missions that contributes to NASA's Earth Science Enterprise (ESE) through its measurements of precipitation that contribute to our knowledge of the global water and energy cycle. This is one of the five priority research themes of ESE. These five themes, which constitute the bulk of the research efforts of ESE to develop an understanding of the total Earth System and the effects of natural and human-induced changes on the global environment, have been defined in the context of national and international research effects. They are:

Ecosystems & Global Carbon Cycle

How do changes in terrestrial and marine ecosystems affect primary productivity and the global carbon budget?

Global Water & Energy Cycle

In what way are atmospheric and hydrological processes that produce severe weather, cause floods, and control water resources related to climate changes?

Climate Variability & Change

Are the changes we observe in the Earth climate associated with mechanisms we can understand, model and predict?

Atmospheric Chemistry

Is stratospheric ozone recovering as a result of the Montreal Protocol? Can long-distance transport cause significant global tropospheric pollution?

Solid Earth and Natural Hazards

Can we understand the dynamics of the Earth interior, and use this knowledge to prepare for natural hazards such as volcanoes and earthquakes?

NASA research announcements such as this one, as well as solicitations for observing missions, are designed and issued in this broader research context. Specifically, this announcement seeks proposals in two areas. The first area is to continue and enhance existing investigations related to algorithm development, validation and applications. TRMM science research consists of a broad range of investigations covering modeling and analysis, algorithm improvements, applications and outreach efforts. Approximately one half of the selected investigations will be related to these efforts. The second area of emphasis deals with the analysis of TRMM validation data collected during Field Experiments. Emphasis here will given to the validation of TRMM products and improvement of physical understanding resulting from the TRMM Field Campaigns. TRMM will have carried out or provided significant resources in 5 Field Campaigns in Texas, the South China Sea, Florida, Brazil (as part of the Large Scale Biosphere-Atmosphere Experiment in Amazonia or LBA) and the Kwajalein atoll. These experiments have all collected ground and airborne data on cloud physics, their corresponding TRMM observations and the atmospheric state in the vicinity of the precipitation**.** The Kwajalein atoll experiment will also contain substantial data from shipborne observations. Tables A and B summarize the key observational systems deployed during each of these experiments. The interested reader may find more information regarding current TRMM research at the TRMM Web page (http://trmm.gsfc.nasa.gov). The TRMM web site also contains links to the several field campaign web pages including many additional ones associated with observational systems, instruments, and/or associated P.I.'s. Both the Science Operations plan as well as the Field Experiment overview are directly relevant to this announcement.

A more detailed description of the specific research areas sought by this announcement is given below:

I. Continuation/Enhancement of Existing Programs

1. Modeling/Data Utilization: Investigators are sought from the weather and climate modeling communities that will make use of TRMM products to continue to advance our understanding of regional to global climate systems. Areas of interest to TRMM include, but are not limited to: Efforts involving data assimilation or studies to determine the sensitivity of models to the quality of rainfall data; model initialization and studies to determine the observational requirements for sustained positive impact on general circulation models; efforts leading to the generation of TRMM products, either alone or in combination with other data sources, that can be readily used by the modeling community.

2. Algorithm Improvement: Investigators are sought in the ongoing effort to refine existing TRMM algorithms, address known deficiencies, work on uncertainty estimates or expand the existing set of retrieved geophysical parameters within the TRMM operational algorithms. Passive microwave, radar, and combinations of passive microwave and radar algorithms are used in TRMM, along with algorithms coupling TRMM products with observations from other satellites. The existing algorithms along with partial lists of known deficiencies can be found on the TRMM home page at http://trmm.gsfc.nasa.gov under "Data" followed by "Algorithm status".

3. Applications: Investigators are sought to continue and enhance the existing efforts to use TRMM rainfall products in related applications. Investigations from all disciplines that have an interest in precipitation will be considered. They may involve either new research efforts or the enhancement of existing programs, and may also include additional data from separate sources. These efforts include, but are not limited to efforts in such areas as oceanography, hydrology and water resources or disaster prevention.

4. Validation data products: Proposals are sought that will generate validation products for TRMM standard products from ground based radar and rain gauge networks. Given the high quality and stable calibration of the TRMM Precipitation Radar, ground based radar products should include the methodology for quality controlling data, as well as any methods to insure unbiased rainfall estimates when compared to local rain gauge networks. In addition to delivering the proposed data products, these proposals may include research leading towards improved operational methods for generating unbiased rainfall estimates from ground based radars. Research may also be aimed at deriving time and space averaged parameters such as drop size distributions that may be appropriate for the improvement of the operational TRMM algorithms. Investigations in this category should lead to products that can be processed routinely. Non-routine efforts should consider the Field Experiment data analysis section below – even if the particular data were not collected during any of the formally sponsored TRMM Field Experiments.

5. Outreach: All science investigators are encouraged to include activities related to science education and public outreach beyond those efforts already being carried out by the TRMM project. The TRMM Web page "Science Background" section, or the Education/Outreach Coordinator for TRMM listed under "Contact Information" may serve as useful starting points for investigators not familiar with the current activities. The outreach activities of each proposal will be judged independently from the scientific portion of the proposal, and may be used to affect the final rankings of the evaluation panel. In addition to these activities, TRMM may also select up to two exceptional proposals dealing exclusively with outreach activities. Of particular interest to TRMM are activities dealing with the visualization of the 3 dimensional hydrometeor structures and latent heat release profiles obtained from TRMM.

II. Analysis of Field Experiment Data

The main goals of the TRMM Field Experiment program are: a) the physical validation of the assumptions made by the TRMM rainfall algorithms, including the latent heating retrievals from the TRMM and Ground Validation sensors, and b) the characterization of clouds and their environment to further refine cloud dynamical models and their ability to properly simulate the observations made by TRMM and the Ground Validation sensors. The complexity of the above tasks will require Team Member and Team Leader activities. At this time, only Team Member proposals will be considered. Proposals should focus upon the continued refinement and analysis of specific Field Experiment data beyond the initial analysis conducted as part of the Field Campaign. Investigators should identify the specific contributions to the TRMM program that will be made by their proposals. In addition to the specific contributions, investigators are encouraged to identify how their proposals might be used as part of a larger effort aimed at resolving the overarching science questions addressed by the TRMM Field experiments. Once the TRMM Science Team is selected, Team Members will be afforded the opportunity to submit a second, Team Leader proposal, to coordinate some of the existing activities towards resolving some of the larger issues mentioned above.

1. Physical Validation: One of the goals of TRMM is to advance our physical understanding of how specific storm structures relate to spaceborne observations. In particular, proposals are sought to advance our ability to scale observations from the point measurements made by in-situ aircraft and ground based sensors, all the way to spatial scales observed by the TRMM satellite. High resolution ground based radar data, often with dual polarization capabilities, profiler, as well as aircraft radar and radiometer data are available to help span the spatial scales. The goals that should be addressed by these proposals are threefold: a) To demonstrate that the high resolution observations made during the field experiments can be related directly through radiative transfer calculations to the TRMM radar and radiometer observations. b) To use the Field Experiment observations to better define latent heating structures that might be derived from TRMM, and c) To define the mean state and variability of microphysical parameters needed to construct error models for the TRMM rainfall products. The parameters needed by TRMM are those, such as the Drop Size Distribution, or the inhomogeneity of rainfall that must be parameterized in the retrieval algorithms but may have a significant impact upon the retrieved rainfall product.

2. Cloud Model Processes: Proposals are sought that will use the Field Experiment data to improve the modeling of the observed precipitation at fine resolutions (1 – 5 km), with the purpose of improving cloud resolving models, improve parameterizations, enhance the use of these models in retrieval algorithms of rainfall, and improve the quality of latent heating profiles derived from TRMM observations. Regional sensitivity studies are encouraged to highlight the model similarities and differences between the five regions studied by the Field Experiments in order to assess their fidelity and applicability to diverse regions of the globe.

TABLE A

	EDOP	ARMAR	AMPR	PSR	MIR	MAMS	AMMR	LIP	MAS	HIS	CPI	HVPS	1DP-Probe	2DC-Probe	2DP-Probe	FSSP-PMS	CLOUDSCOPE	MMS	DROPSONDE	LASE	MACAWS	LIQ. H20 (opt.)	LIQ. H20 (opt. sct.)	g-METER	SLS	NAST-MTS	NAST-I
ER-2																											
TEFLUN-A	✔		✔		✔	✔		✔																	✔		
TEFLUN-B	✔		✔		✔	✔																				✔	✔
TRMM-LBA	✔		✔		✔			✔	✔																		
Cloud Phys. Jet																											
TEFLUN-A											✔	✔		✔		✔											
TEFLUN-B											✔	✔	✔	✔		✔											
TRMM-LBA											✔	✔	✔	✔		✔		✔									
KWAJEX											✔	✔	✔	✔		✔											
DC-8																											
TEFLUN-B		✔		✔			✔	✔					✔	✔	✔	✔	✔	✔	✔	✔	✔						
KWAJEX		✔	✔							✔	✔		✔	✔		✔	✔										
Convair 580																											
KWAJEX							✔				✔	✔	✔	✔	✔	✔						✔	✔	✔			

Aircraft (A/C)

ER-2--NASA High Altitude Research A/C

Cloud Physics Jet (Lear)--SPEC, Inc.,--TEFLUN-A;
Citation/Univ. N. Dakota--TEFLUN-B, TRMM-LBA-KWAJEX

DC-8--NASA Douglas DC-8 Research A/C

Convair 580--Univ. of Washington, Turbo-Prop. Research A/C

Instruments

EDOP--ER-2 Doppler Radar (9.7 GHz)

ARMAR--GHz Airborne Rain Mapping Radar (13.7 GHz)

AMPR--Advanced Multichannel Microwave Precipitation Radiometer

PSR--Polarimetric Scanning Radiometer

MIR--Millimeter-wave Imaging Radiometer

MAMS--Multispectral Atmospheric Moisture Sounder

AMMR--Advanced Microwave Precipitation Radiometer

LIP--Lightning Instrument Package

MAS--MODIS Airborne Simulator

HIS--High Resolution Interferometer Spectrometer--VIS/IR Radiometer

Instruments (Continued)

CPI--Cloud Particle Imager

HVPS--High Velocity Precipitation Sensor

1-DP-Probe (one dimensional precipitation)

2-DC-Probe (two dimensional cloud)

2-DP-Probe (two dimensional precipitation)

FSSP-PMS (forward scattering spectrometer probe)

Cloudscope--(Optical Window Impact Sensor)

MMS--Meteorological Measuring System

Dropsonde--Atmospheric Soundings

LASE--LIDAR Atmospheric Sensing Experiment

MACAWS--Multi-Center Airborne Coherent Atmospheric Wind Sensor

Hot wire resistence probes (Liq. H_2O (content)

PVM-100A--Particle Velocity Measurement (Liq. H_2O content)

g-Meter--Gerber (optical scattering/extinction coefficients)

SLS--Sub-Millimeter Limb Sounder

NAST-MTS--NPOESS A/C Sounder Testbed--Microwave Temperature Sensor

NAST-I--NPOESS A/C Sounder Testbest--Interferometer

TABLE B

	TEFLUN-A	SCSMEX	TEFLUN-B	TRMM-LBA	KWAJEX
RADARS					
WSR-93D					✔
WSR-88D	✔		✔		
ADRAD	✔				
C-POL		✔			
TOGA		✔		✔	
S-POL			✔	✔	
X-POL	✔				
C-SDWR					✔
PROFILERS					
S-BAND	✔		✔	✔	✔
915 MHZ	✔		✔	✔	✔
S-BAND (ship)					✔
915 MHz (ship)					✔
X-BAND			✔		
C/G LTGN. NET.				✔	
F/P LTGN. NET.				✔	
DISDROMETERS					
2-D VIDEO (U. of IA)			✔	✔	✔
2-D VIDEO (NASA)			✔	✔	✔
IMPACT (Joss-RD-69) (including ship)		✔	✔	✔	✔
IMPACT (APL)			✔	✔	✔
RAIN GAUGE NETWORKS	✔	✔ 1	✔	✔	✔
RADIOSONDE NETWORKS	✔	✔	✔	✔	✔
TETHERSONDE				✔	✔
SODAR				✔	✔
FLUX TOWER				✔	✔
MIT-EFM				✔	
MIT-CCNC				✔	
OCEAN SURFACE FLUX (ship)					✔
WATER VAPOR/LIQUID RADIOMETER (ship)					✔
MICROWAVE POLARIMETERS (ship)					✔
5-mm SCANNING RADIOMETER (ship)					✔
INFRARED RADIOMETER (ship)					✔
OSCS (ship)					✔

[1]Limited

KWR--Kwajalein Weather Radar (10-cm, multiparameter)
WSR-88D--"NOAA/NEXRAD" Weather Surveillance Radar (10-cm Doppler)
ADRAD--Aggie Doppler Radar (10-cm)
C-pol--Bureau of Meteorology Research Center, Australia, Research Radar (5-cm, multiparameter
TOGA--(Tropical Oceans Global Atmosphere), NOAA/NASA Research Radar (5-cm, Doppler)
S-pol--National Center for Atmospheric Research (NCAR) Research Radar (10-cm, multiparameter)
X-pol--NOAA/Environmental Technology Laboratories (ETL) Research Radar (9.5 cm, multiparameter)
C-SDWR--Shipboard DopplerWeather Radar--NOAA R/V Ron Brown (5-cm

Doppler)
Profilers--NOAA/Environmental Technology Laboratories (ETL) S-band (10 cm) and 915 MHz profiler radars
Profiler--U. of Iowa, X-band (3 cm) Vertical Pointing Radar
C/G Ltgn. Net.--Cloud to Ground Lightning Network
F/P LTGN. Net.--Flat Plate Lightning Network
Disdrometers 2-D Video--(2) Two Dimensional Video (imaging), U. of Iowa; NASA
Disdrometer Impact--(1 to 3) Joss/Waldvogel--Distromet RD-69 NASA (1); Texas A&M (1); U. of WA (1)
Disdrometer Impact--(Variable to 10) APL Design NASA/NOAA Fabricated and Calibrated
Rain Gauge Networks--Tipping Bucket Rain-Rate Gauges
Radiosonde Networks--VIZ; Vaisala, AIR; MSS, Type Sondes
Tethersonde--Tethered Kytoon Type Balloon with Multi-Sensor Atmospheric Sounding Package for Observations to 500 Meters
SODAR--Acoustic Profiler for Low Level Winds
Flux Tower--Low Level Flux Parameters and Parameters and Atmospheric Constituents
MIT-EFM--Electric Field Mill
MIT-CCNC--Cloud Condensation Nuclei Counter
Ocean Surface Flux (Ship)--Heat, Momentum, Moisture, C02
Water Vapor/Liquid Radiometer (ship)--Boundary Layer Observations
Microwave Polarimeters (ship)--Sea Surface Roughness
5mm--Scanning Radiometer (ship)--Temperature Profiles to 300m
Infrared Radiometer (ship)--IR Fluxes
OSCS--Ocean Surface Cross-Section Scatterometer

Appendix B

INSTRUCTIONS FOR RESPONDING TO NASA RESEARCH ANNOUNCEMENTS

Part 1852.235-72
NASA Federal Acquisition Regulations (FAR) Supplement (NFS) Version 89.90, Effective March 11, 1997.

Accessible at URL
http://www.hq.nasa.gov/office/procurement/regs/nfstoc.htm, open Part 1852.228 to 1852.241 from menu.

(JANUARY 1997)

(a) General.

(1) Proposals received in response to a NASA Research Announcement (NRA) will be used only for evaluation purposes. NASA does not allow a proposal, the contents of which are not available without restriction from another source, or any unique ideas submitted in response to an NRA to be used as the basis of a solicitation or in negotiation with other organizations, nor is a pre-award synopsis published for individual proposals.

(2) A solicited proposal that results in a NASA award becomes part of the record of that transaction and may be available to the public on specific request; however, information or material that NASA and the awardee mutually agree to be of a privileged nature will be held in confidence to the extent permitted by law, including the Freedom of Information Act.

(3) NRAs contain programmatic information and certain requirements which apply only to proposals prepared in response to that particular announcement. These instructions contain the general proposal preparation information which applies to responses to all NRAs.

(4) A contract, grant, cooperative agreement, or other agreement may be used to accomplish an effort funded in response to an NRA. NASA will determine the appropriate instrument. Contracts resulting from NRAs are subject to the Federal Acquisition Regulation and the NASA FAR. Supplement. Any resultant grants or cooperative agreements will be awarded and administered in accordance with the NASA Grant and Cooperative Agreement Handbook (NPG 5800.1).

(5) NASA does not have mandatory forms or formats for responses to NRAs; however, it is requested that proposals conform to the guidelines in these instructions. NASA may acceptp proposals without discussion; hence, proposals should initially be as complete as possible and be submitted on the proposers' most favorable terms.

(6) To be considered for award, a submission must, at a minimum, present a specific project within the areas delineated by the NRA; contain sufficient technical and cost information to permit a meaningful evaluation; be signed by an official authorized to

legally bind the submitting organization; not merely offer to perform standard services or to just provide computer facilities or services; and not significantly duplicate a more specific current or pending NASA solicitation.

(b) NRA-Specific Items. Several proposal submission items appear in the NRA itself: the unique NRA identifier; when to submit proposals; where to send proposals; number of copies required; and sources for more information. Items included in these instructions may be supplemented by the NRA.

(c) The following information is needed to permit consideration in an objective manner. NRAs will generally specify topics for which additional information or greater detail is desirable. Each proposal copy shall contain all submitted material, including a copy of the transmittal letter if it contains substantive information.

(1) Transmittal Letter or Prefatory Material.

(i) The legal name and address of the organization and specific division or campus identification if part of a larger organization;

(ii) A brief, scientifically valid project title intelligible to a scientifically literate reader and suitable for use in the public press;

(iii) Type of organization: e.g., profit, nonprofit, educational, small business, minority, women-owned, etc.;

(iv) Name and telephone number of the principal investigator and business personnel who may be contacted during evaluation or negotiation;

(v) Identification of other organizations that are currently evaluating a proposal for the same efforts;

(vi) Identification of the NRA, by number and title, to which the proposal is responding;

(vii) Dollar amount requested, desired starting date, and duration of project;

(viii) Date of submission; and

(ix) Signature of a responsible official or authorized representative of the organization, or any other person authorized to legally bind the organization (unless the signature appears on the proposal itself).

(2) **Restriction on Use and Disclosure of Proposal Information**. Information contained in proposals is used for evaluation purposes only. Offerors or quoters should, in order to maximize protection of trade secrets or other information that is confidential or privileged, place the following notice on the title page of the proposal and specify the information subject to the notice by inserting an appropriate identification in the notice. In any event, information contained in proposals will be protected to the extent permitted by law, but NASA assumes no liability for use and disclosure of information not made subject to the notice.

Notice

Restriction on Use and Disclosure of Proposal Information

The information (data) contained in [insert page numbers or other identification] of this proposal constitutes a trade secret and/or information that is commercial or financial and confidential or privileged. It is furnished to the Government in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed other than for evaluation purposes; provided, however, that in the event a contract (or other agreement) is awarded on the basis of this proposal the Government shall have the right to use and disclose this information (data) to the extent provided in the contract (or other agreement). This restriction does not limit the Government's right to use or disclose this information (data) if obtained from another source without restriction.

(3) **Abstract.** Include a concise (200-300 word if not otherwise specified in the NRA) abstract describing the objective and the method of approach.

(4) **Project Description**.

(i) The main body of the proposal shall be a detailed statement of the work to be undertaken and should include objectives and expected significance; relation to the present state of knowledge; and relation to previous work done on the project and to related work in progress elsewhere. The statement should outline the plan of work, including the broad design of experiments to be undertaken and a description of experimental methods and procedures. The project description should address the evaluation factors in these instructions and any specific factors in the NRA. Any substantial collaboration with individuals not referred to in the budget or use of consultants should be described. Subcontracting significant portions of a research project is discouraged.

(ii) When it is expected that the effort will require more than one year, the proposal should cover the complete project to the extent that it can be reasonably anticipated. Principal emphasis should be on the first year of work, and the description should distinguish clearly between the first year's work and work planned for subsequent years.

(5) **Management Approach**. For large or complex efforts involving interactions among numerous individuals or other organizations, plans for distribution of responsibilities and arrangements for ensuring a coordinated effort should be described.

(6) **Personnel**. The principal investigator is responsible for supervision of the work and participates in the conduct of the research regardless of whether or not compensated under the award. A short biographical sketch of the principal investigator, a list of principal publications and any exceptional qualifications should be included. Omit social security number and other personal items which do not merit consideration in evaluation of the proposal. Give similar biographical information on other senior professional personnel who will be directly associated with the project. Give the names and titles of any other scientists and technical personnel associated substantially with the project in an advisory capacity. Universities should list the

approximate number of students or other assistants, together with information as to their level of academic attainment. Any special industry-university cooperative arrangements should be described.

(7) **Facilities and Equipment.**

(i) Describe available facilities and major items of equipment especially adapted or suited to the proposed project, and any additional major equipment that will be required. Identify any Government-owned facilities, industrial plant equipment, or special tooling that are proposed for use. Include evidence of its availability and the cognizant Government points of contact.

(ii) Before requesting a major item of capital equipment, the proposer should determine if sharing or loan of equipment already within the organization is a feasible alternative. Where such arrangements cannot be made, the proposal should so state. The need for items that typically can be used for research and non-research purposes should be explained.

(8) **Proposed Costs.**

(i) Proposals should contain cost and technical parts in one volume: do not use separate
"confidential" salary pages. As applicable, include separate cost estimates for salaries and wages; fringe benefits; equipment; expendable materials and supplies; services; domestic and foreign travel; ADP expenses; publication or page charges; consultants; subcontracts; other miscellaneous identifiable direct costs; and indirect costs. List salaries and wages in appropriate organizational categories (e.g., principal investigator, other scientific and engineering professionals, graduate students, research assistants, and technicians and other non-professional personnel). Estimate all staffing data in terms of staff-months or fractions of full-time.

(ii) Explanatory notes should accompany the cost proposal to provide identification and estimated cost of major capital equipment items to be acquired; purpose and estimated number and lengths of trips planned; basis for indirect cost computation (including date of most recent negotiation and cognizant agency); and clarification of other items in the cost proposal that are not self-evident. List estimated expenses as yearly requirements by major work phases.

(iii) Allowable costs are governed by FAR Part 31 and the NASA FAR Supplement Part 1831 (and OMB Circulars A-21 for educational institutions and A-122 for nonprofit organizations).

(9) **Security**. Proposals should not contain security classified material. If the research requires access to or may generate security classified information, the submitter will be required to comply with Government security regulations.

(10) **Current Support**. For other current projects being conducted by the principal investigator, provide title of project, sponsoring agency, and ending date.

(11) **Special Matters.**

(i) Include any required statements of environmental impact of the research, human subject or animal care provisions, conflict of interest, or on such other topics as may be required by the nature of the effort and current statutes, executive orders, or other current Government-wide guidelines.

(ii) Proposers should include a brief description of the organization, its facilities, and previous work experience in the field of the proposal. Identify the cognizant Government audit agency, inspection agency, and administrative contracting officer, when applicable.

(d) **Renewal Proposals**

(1) Renewal proposals for existing awards will be considered in the same manner as proposals for new endeavors. A renewal proposal should not repeat all of the information that was in the original proposal. The renewal proposal should refer to its predecessor, update the parts that are no longer current, and indicate what elements of the research are expected to be covered during the period for which support is desired. A description of any significant findings since the most recent progress report should be included. The renewal proposal should treat, in reasonable detail, the plans for the next period, contain a cost estimate, and otherwise adhere to these instructions.

(2) NASA may renew an effort either through amendment of an existing contract or by a new award.

(e) **Length.** Unless otherwise specified in the NRA, effort should be made to keep proposals as brief as possible, concentrating on substantive material. Few proposals need exceed 15-20 pages. Necessary detailed information, such as reprints, should be included as attachments. A complete set of attachments is necessary for each copy of the proposal. As proposals are not returned, avoid use of "one-of-a-kind" attachments.

(f) **Joint Proposals**.

(1) Where multiple organizations are involved, the proposal may be submitted by only one of them. It should clearly describe the role to be played by the other organizations and indicate the legal and managerial arrangements contemplated. In other instances, simultaneous submission of related proposals from each organization might be appropriate, in which case parallel awards would be made.

(2) Where a project of a cooperative nature with NASA is contemplated, describe the contributions expected from any participating NASA investigator and agency facilities or equipment which may be required. The proposal must be confined only to that which the proposing organization can commit itself. "Joint" proposals which specify the internal arrangements NASA will actually make are not acceptable as a means of establishing an agency commitment.

(g) **Late Proposals**. A proposal or modification received after the date or dates specified in an NRA may be considered if doing so is in the best interests of the Government.

(h) **Withdrawal.** Proposals may be withdrawn by the proposer at any time before award. Offerors are requested to notify NASA if the proposal is funded by another organization or of other changed circumstances which dictate termination of evaluation.

(i) **Evaluation Factors**

(1) Unless otherwise specified in the NRA, the principal elements (of approximately equal weight) considered in evaluating a proposal are its relevance to NASA's objectives, intrinsic merit, and cost.

(2) Evaluation of a proposal's relevance to NASA's objectives includes the consideration of the potential contribution of the effort to NASA's mission.

(3) Evaluation of its intrinsic merit includes the consideration of the following factors of equal importance:

(i) Overall scientific or technical merit of the proposal or unique and innovative methods, approaches, or concepts demonstrated by the proposal.

(ii) Offeror's capabilities, related experience, facilities, techniques, or unique combinations of these which are integral factors for achieving the proposal objectives.

(iii) The qualifications, capabilities, and experience of the proposed principal investigator, team leader, or key personnel critical in achieving the proposal objectives.

(iv) Overall standing among similar proposals and/or evaluation against the state-of-the-art.

(4) Evaluation of the cost of a proposed effort may include the realism and reasonableness of the proposed cost and available funds.

(j) **Evaluation Techniques**. Selection decisions will be made following peer and/or scientific review of the proposals. Several evaluation techniques are regularly used within NASA. In all cases proposals are subject to scientific review by discipline specialists in the area of the proposal. Some proposals are reviewed entirely in-house, others are evaluated by a combination of in-house and selected external reviewers, while yet others are subject to the full external peer review technique (with due regard for conflict-of-interest and protection of proposal information), such as by mail or through assembled panels. The final decisions are made by a NASA selecting official. A proposal which is scientifically and programmatically meritorious, but not selected for award during its initial review, may be included in subsequent reviews unless the proposer requests otherwise.

(k) **Selection for Award**.

(1) When a proposal is not selected for award, the proposer will be notified. NASA will explain generally why the proposal was not selected. Proposers desiring additional information may contact the selecting official who will arrange a debriefing.

(2) When a proposal is selected for award, negotiation and award will be handled by the
procurement office in the funding installation. The proposal is used as the basis for negotiation. The contracting officer may request certain business data and may forward a model award instrument and other information pertinent to negotiation.

(l) **Cancellation of NRA**. NASA reserves the right to make no awards under this NRA and to cancel this NRA. NASA assumes no liability for canceling the NRA or for anyone's failure to receive actual notice of cancellation.

APPENDIX C

NRA SOLICITATION PROVISION

FOREIGN PROPOSALS AND PROPOSALS INCLUDING FOREIGN PARTICIPATION IN RESPONSE TO NASA RESEARCH ANNOUNCEMENTS

(a) NASA welcomes proposals from outside the U.S. However, investigators working outside the U.S. are not eligible for funding from NASA. Proposals from non-U.S. entities should not include a cost plan. Proposals from outside the U.S. and U.S. proposals that include non-U.S. participation must be endorsed by the respective government agency or funding/sponsoring institution in that country from which the non-U.S. participant is proposing. Such endorsement should indicate that the proposal merits careful consideration by NASA, and if the proposal is selected, sufficient funds will be made available to undertake the activity as proposed.

(b) Successful and unsuccessful proposers will be contacted directly by the NASA sponsoring office. Copies of these letters will be sent to the sponsoring government agency. Should a non-U.S. proposal or a U.S. proposal with non-U.S. participation be selected, NASA's Office of External Relations, Space Science and Aeronautics Division will arrange with the non-U.S. sponsoring agency for the proposed participation on a no-exchange-of-funds basis, in which NASA and the non-U.S. sponsoring agency will each bear the cost of discharging their respective responsibilities. Depending on the nature and extent of the proposed cooperation, these arrangements may entail:

1. A letter of notification by NASA, and
2. An exchange of letters between NASA and the sponsoring governmental agency; or
3. A formal Agency-to-Agency Memorandum of Understanding (MOU).

(c) As stated in Paragraph b. above, foreign proposals accepted under this NRA will be implemented on the customary no-exchange-of-funds basis in which NASA and the sponsoring foreign agency will each bear the cost of discharging their respective responsibilities. Additionally, NASA funding may not be used to purchase a launch service from a non-U.S. source. However, the direct purchase of goods and/or services from non-U.S. sources by U.S. Principal Investigators or U.S. Co-Investigators is permitted. Proposers are advised that international purchases must meet NASA and Federal regulations and that these regulations may place an additional burden on the successful proposer that should be explicitly included in discussions of the proposed budget.

Appendix D

Proposal Cover Sheet

NASA Research Announcement 99-OES-03
Proposal No. _____ (Leave Blank for NASA Use)

Title: _____

Principal Investigator:_____

Department:_____

Institution: _____

Street/PO Box: _____

City: _____ State: _____ Zip: _____

Country: _____ E-mail: _____

Telephone: _____ Fax: _____

Co-Investigators:

Name	Institution & Email Address	Telephone & Address
_____	_____	_____
_____	_____	_____
_____	_____	_____

Budget:
1st Year: _____ 2nd Year: _____ 3rd Year: _____ Total: _____

Certification of Compliance with Applicable Executive Orders and U.S. Code

By submitting the proposal identified in this *Cover Sheet/Proposal Summary* in response to this Research Announcement, the Authorizing Official of the proposing institution (or the individual proposer if there is no proposing institution) as identified below:

- certifies that the statements made in this proposal are true and complete to the best of his/her knowledge;
- agrees to accept the obligations to comply with NASA award terms and conditions if an award is made as a result of this proposal; and
- confirms compliance with all provisions, rules, and stipulations set forth in the two Certifications contained in this NRA [namely, (i*) Certification of Compliance with the NASA Regulations Pursuant to Nondiscrimination in Federally Assisted Programs*, *and (ii) Certifications, Disclosures, And Assurances Regarding Lobbying and Debarment & Suspension*].

Willful provision of false information in this proposal and/or its supporting documents, or in reports required under an ensuing award, is a criminal offense (U.S. Code, Title 18, Section 1001).

Title of Authorizing Institutional Official: _____

Signature: _____ Date: _____

Name of Proposing Institution: _____

Telephone: _____ E-mail:_____ Facsimile: _____

Certification of Compliance with the NASA Regulations Pursuant to Nondiscrimination in Federally Assisted Programs

The *(Institution, corporation, firm, or other organization on whose behalf this assurance is signed, hereinafter called "Applicant ")* hereby agrees that it will comply with Title VI of the Civil Rights Act of 1964 (P.L. 88-352), Title IX of the Education Amendments of 1962 (20 U.S.C. 1680 et seq.), Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and the Age Discrimination Act of 1975 (42 U.S.C. 16101 et seq.), and all requirements imposed by or pursuant to the Regulation of the National Aeronautics and Space Administration (14 CFR Part 1250) (hereinafter called "NASA") issued pursuant to these laws, to the end that in accordance with these laws and regulations, no person in the United States shall, on the basis of race, color, national origin, sex, handicapped condition, or age be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity for which the Applicant receives federal financial assistance from NASA; and hereby give assurance that it will immediately take any measure necessary to effectuate this agreement.

If any real property or structure thereon is provided or improved with the aid of federal financial assistance extended to the Applicant by NASA, this assurance shall obligate the Applicant, or in the case of any transfer of such property, any transferee, for the period during which the real property or structure is used for a purpose for which the federal financial assistance is extended or for another purpose involving the provision of similar services or benefits. If any personal property is so provided, this assurance shall obligate the Applicant for the period during which the federal financial assistance is extended to it by NASA.

this assurance is given in consideration of and for the purpose of obtaining any and all federal grants, loans, contracts, property, discounts, or other federal financial assistance extended after the date hereof to the Applicant by NASA, including installment payments after such date on account of applications for federal financial assistance which were approved before such date. The Applicant recognized and agrees that such federal financial assistance will be extended in reliance on the representations and agreements made in this assurance, and that the United States shall have the right to seek judicial enforcement of this assurance. This assurance is binding on the Applicant, its successors, transferees, and assignees, and the person or persons whose signatures appear below are authorized to sign on behalf of the Applicant.

NASA FORM 1206

CERTIFICATIONS, DISCLOSURES, AND ASSURANCES
REGARDING LOBBYING AND DEBARMENT & SUSPENSION

1. LOBBYING

As required by Section 1352, Title 31 of the U.S. Code, and implemented at 14 CFR Part 1271, as defined at 14 CFR Subparts 1271.110 and 1260.117, with each submission that initiates agency consideration of such applicant for award of a Federal contract, grant, or cooperative agreement exceeding $ 100,000, the applicant must **certify** that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit a Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

2. GOVERNMENTWIDE DEBARMENT AND SUSPENSION

As required by Executive Order 12549, and implemented at 14 CFR 1260.510, for prospective participants in primary covered transactions, as defined at 14 CFR Subparts 1265.510 and 1260.117—

(1) The prospective primary participant **certifies** to the best of its knowledge and belief, that it and its principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by any Federal department or agency.

(b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (l)(b) of this certification; and

(d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

(2) Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

Appendix D

Letter of Intent

All prospective proposers are strongly encouraged to submit a letter of intent in response to this announcement. This will allow us to alert a peer review staff to adequately cover the proposal review process. This letter of intent is available electronically via the Internet at URL: *http://www.earth.nasa.gov/LOI***.** We urge you to use these electronic letter of intent forms unless you do not have access to the Internet. In that case, we will accept a FAX copy sent to 202-554-3024 with the following information:

- PI and CoI names and addresses, (including Zip + 4);
- Title of proposal;
- Telephone number;
- Fax number;
- Email address; and
- A brief summary of what you plan to propose (Please limit this to no more than 3000 characters).

APPENDIX E

BUDGET SUMMARY

For period from _____ to _____

- Provide a complete Budget Summary for year one and separate estimated for each subsequent year.
- Enter the proposed estimated costs in Column A (Columns B & C for NASA use only).
- Provide as attachments detailed computations of all estimates in each cost category with narratives as required to fully explain each proposed cost. See *Instructions For Budget Summary* on following page for details.

		NASA USE ONLY	
	A	**B**	**C**
1. Direct Labor (salaries, wages, and fringe benefits)	_____	_____	_____
2. Other Direct Costs:			
a. Subcontracts	_____	_____	_____
b. Consultants	_____	_____	_____
c. Equipment	_____	_____	_____
d. Supplies	_____	_____	_____
e. Travel	_____	_____	_____
f. Other	_____	_____	_____
3. Facilities and Administrative Costs	_____	_____	_____
4. Other Applicable Costs:	_____	_____	_____
5. SUBTOTAL--Estimated Costs	_____	_____	_____
6. Less Proposed Cost Sharing (if any)	_____	_____	_____
7. Carryover Funds (if any)			
a. Anticipated amount : _____			
b. Amount used to reduce budget	_____	_____	_____
8. Total Estimated Costs	_____	_____	XXXXXXX
9. APPROVED BUDGET	XXXXXX	XXXXXXX	_____

INSTRUCTIONS FOR BUDGET SUMMARY

1. Direct Labor (salaries, wages, and fringe benefits): Attachments should list the number and titles of personnel, amounts of time to be devoted to the grant, and rates of pay.

2. Other Direct Costs:
    a. Subcontracts: Attachments should describe the work to be subcontracted, estimated amount, recipient (if known), and the reason for subcontracting.
    b. Consultants: Identify consultants to be used, why they are necessary, the time they will spend on the project, and rates of pay (not to exceed the equivalent of the daily rate for Level IV of the Executive Schedule, exclusive of expenses and indirect costs).
    c. Equipment: List separately. Explain the need for items costing more than $5,000. Describe basis for estimated cost. General purpose equipment is not allowable as a direct cost unless specifically approved by the NASA Grant Officer. Any equipment purchase requested to be made as a direct charge under this award must include the equipment description, how it will be used in the conduct of the basic research proposed and why it cannot be purchased with indirect funds.
    d. Supplies: Provide general categories of needed supplies, the method of acquisition, and the estimated cost.
    e. Travel: Describe the purpose of the proposed travel in relation to the grant and provide the basis of estimate, including information on destination and number of travelers where known.
    f. Other: Enter the total of direct costs not covered by 2a through 2e. Attach an itemized list explaining the need for each item and the basis for the estimate.

3. Facilities and Administrative (F&A) Costs: Identify F&A cost rate(s) and base(s) as approved by the cognizant Federal agency, including the effective period of the rate. Provide the name, address, and telephone number of the Federal agency official having cognizance. If unapproved rates are used, explain why, and include the computational basis for the indirect expense pool and corresponding allocation base for each rate.

4. Other Applicable Costs: Enter total explaining the need for each item.

5. Subtotal-Estimated Costs: Enter the sum of items 1 through 4.

6. Less Proposed Cost Sharing (if any): Enter any amount proposed. If cost sharing is based on specific cost items, identify each item and amount in an attachment.

7. Carryover Funds (if any): Enter the dollar amount of any funds expected to be available for carryover from the prior budget period Identify how the funds will be used if they are not used to reduce the budget. NASA officials will decide whether to use all or part of the anticipated carryover to reduce the budget (not applicable to 2nd-year and subsequent-year budgets submitted for award of a multiple year award).

8. Total Estimated Costs: Enter the total after subtracting items 6 and 7b from item 5.